TEACHING NOTES

David Robinson: Building the 777

Appropriate Grade Levels: *9 – 12*

Implementation Time:
One class period (45 minutes to one hour) required for case study and in-class written exercise. Additional time may be desired to have students pursue the suggested research projects.

Materials Needed:
Teaching notes for "David Robinson" case study
Student copies of "David Robinson"

Career Pathway: *Engineering, Industry & Science*

Subject Area: *Social Studies*

Learner Outcome(s): What will happen for learners as a result of this lesson?
Students will explore a career opportunity in international transportation and manufacturing. They will review basic research, problem analysis, and data collection skills and then will demonstrate their ability to manage a problem-solving mission and communicate both their approach and their findings through standard business communication formats.

Washington State Essential Academic Learning Requirements: How will students learn?
- *Communication: Students will use listening and observation skills to gain understanding; will explore different perspectives on complex issues; will demonstrate their ability to make a well reasoned, insightful presentation supported by related details; will demonstrate their ability to use language to influence others; and will demonstrate their ability to respect that a solution may require honoring other points of view. .*
  (EALR's 1.1, 1.2, 1.3, 2.2, 2.3, 2.4, 3.1, 3.3)
- *Writing: Students will demonstrate their ability to write clearly and effectively, as well as to use writing to reflect upon their own experiences, to communicate, to make inferences or draw conclusions, and to present convey technical information. Students will also gain experience writing for a career application, and identify particular writing and analytical skills required for occupational/career areas of interest.*
  (EALR's 1.2, 1.3, 2.4, 3.1, 3.2, 3.3, 3.4, 4.1)

Washington Assessment of Student Learning (WASL). How will students' learning be measured? *This lesson plan will help prepare students for the 10th grade WASL exams in reading and writing. The in-class written assignment will provide students with an opportunity to respond to a persuasive writing prompt using a standard business format.*

Procedure: *This lesson is designed to be taught in one class session. Allow approximately 15 minutes for students to read and discuss the case study. Then ask them, either individually or in small groups to complete the in-class written exercise. After 20 minutes, ask students to present their proposals.*

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Closure/Assessment:
Collect students' in-class assignments. Review these both for basic writing skills as well as for their ability to coherently develop a strategy for David, taking into account the needs of the other people who will be affected by his proposal.

As part of the closure for the class session, review with students the essential underpinnings for any problem-solving exercise: understanding the information you need to solve the problem, determining where to obtain that information, developing a plan of action to solve the problem, evaluating how others will be affected by your action plan, and determining how to communicate your action plan.

David Robinson: Building the 777

David Robinson studied the engine diagrams. He had an idea that would make installing the airplane engines more efficient. Now he had to make his idea a reality.

David Robinson was a lead engine mechanic for The Boeing Company. He worked at the Boeing plant in Everett, Washington. David had worked for Boeing for 20 years, receiving regular training to keep up to date on airplane manufacturing. He and the crew members who worked for him were members of the International Association of Machinists and Aerospace Workers union.

Boeing had been manufacturing airplanes since the early 20th century and now sold its airplanes, jets and helicopters all over the world. The 777, on which David and his crew worked, was Boeing's newest jet airliner. The 777 had been developed by Boeing in the early 1990s to meet the needs of Boeing's customers who wanted a large jet sized between the smaller 767 and jumbo 747, which would cost less to operate. The 777 was designed to meet all those needs.

The 777-200 extended range, the most popular 777 model, can hold more than 400 passengers at a time, depending on the interior configuration. It can fly more than 8,000 miles without stopping, meaning that it can easily fly across the Pacific, say from Los Angeles to Tokyo. And, because the huge engines that power the 777 are powerful and fuel-efficient, the plane burns less fuel than other jet airplanes, making it cheaper for airlines to operate. The 777 is the first of Boeing's planes to be designed completely on computer.

David's crew's job on the 777 was to attach the plane's engines to its wings. The 777 engine struts, which hold the engine to the wing, were built at the Boeing plant in Wichita, Kansas from components that came from suppliers from all over the world. After the struts were completed, they were sent from Wichita to David's plant in Everett to be attached to the plane.

However, when David and his crew attached the engines to the wings, they had to remove several parts from the engine struts and then reattach them after the engine was installed. This was not all that uncommon a procedure, since the engines and wings were built separately and then had to be configured to work together. But, David was convinced there was a better, simpler way to attach the engines.

David reviewed engineering diagrams and his crew's job. He thought that several of the insulation blankets and bearings that were built into the engine struts in Wichita could be left off the engine struts at first. These parts could then be attached by his crew after the engine struts were mounted on the wings. That way, these parts would only have to be attached once, not twice. This would streamline the manufacturing process. However, it would mean that the mechanics at the Wichita plant would have to change the way they worked. What should David do?

Teaching Notes for David Robinson Case Study

1. *Ensure that students understand what David does and the challenge he wants to solve. They should be able to answer that David and his crew assemble and attach engine struts for the 777 jet airplane for Boeing. Make sure students understand why David might suggest a different way to manufacture the engine struts to make his crew's work more efficient.*

2. *Ask students what they would do if they were David.*

   Ask them first what information they might want to have:
   - *Students may say that they want to know all the pieces in the engine struts that can best be installed after the engines are mounted on the wings.*
   - *They may say that they would want to understand whether temporarily leaving these parts off the engine struts would cause problems in the engine manufacturing process, because they wouldn't want to propose a new idea that would cause problems.*
   - *They may say they want to know who would be affected by David's idea to change the manufacturing process.*

   Now ask students how they would get the information David needs:
   - *They might talk with other Boeing workers to review the steps in the engine struts manufacturing process.*
   - *They might examine engine specifications that describe how the engine is manufactured and identify the specific parts that could be held aside and installed later.*
   - *They might use their computer to track each individual engine through the manufacturing process to learn where in the process the strut parts are installed..*

   Then ask students who they think will be affected by David's idea to change the manufacturing process. How will those people feel about what David is doing?
   - *They might answer that David's crew will be affected. They will probably welcome a new way to do their job that makes it more efficient.*
   - *Students might answer that people at the Wichita factory that have something to do with the strut parts might be affected. They will probably be willing to change their processes to make the entire process more efficient, but they will want to be assured that David's idea won't cause them any problems and won't make their work more difficult.*

Now ask students what they think David should do. Note their answers on the blackboard and ask for student feedback about each idea. Do students think it would work?

Next, give students the following in-class writing assignment.

David Robinson: In-class Writing Assignment

David Robinson has decided that the best way to make the engine installation process more efficient is to ask the Wichita crew to send separately to Everett several parts for the engine struts. The Wichita team usually installs these parts when they build the engine struts; David's crew uninstalls these parts so that the engines can be attached to the wings; and then David's crew reinstalls these parts.

David has carefully researched the manufacturing process and has determined that his proposal should not cause any safety or manufacturing problems in building the engines. It should be just an improvement to the manufacturing process, and factories all over the world improve their manufacturing processes every day based on new equipment, new designs, or just good ideas of ways to do things better. David also doesn't think it will take much longer for the Wichita crew to package the strut parts separately and send them on to Everett.

David now needs to make his proposal to the crew in Wichita that is responsible for building the engine struts. For the purposes of this exercise, please assume that the parts David wants to have held aside are called 777-strut-insulation-1117 and 777-strut-bearing-2111, 2112, and 2113.

Please compose a three-paragraph e-mail from David Robinson to the 777 Lead Engine Mechanics in Wichita. The e-mail should include the following information:

1. A brief description of the challenge. That is, why is David proposing this idea in the first place?
2. David's proposal, backed up by noting that he has carefully researched the manufacturing process.
3. The request that the two crews prepare drawings and specifications for a new manufacturing process using David's proposal.

Remember, David does not supervise the Wichita crew. They will probably be eager to improve the manufacturing process, but not if it looks like David hasn't researched his proposal carefully or if it looks like he is just trying to dump more work on them. Please be careful as you write to make sure you do not cause problems between David and the Wichita Lead Engine Mechanics.

Answer Key: One suggested response: David Robinson – Writing Assignment

E-Mail Message

TO: Boeing 777 Wichita Lead Engine Mechanics
FROM: David Robinson, Lead Engine Mechanic, Everett Washington plant
RE: Engine manufacturing process

Background
My crew and I work at the Everett plant. We attach the 777 engines to the wings. To do that, we must uninstall several parts from the engine struts and then reinstall them after the engines are mounted on the wings. I have been doing research to determine whether there is a more efficient manufacturing process that would allow us to install these strut parts only once. I would like to present a proposal to you.

Proposed Solution
After careful review of our manufacturing process and engineering diagrams, I believe that the following parts – 777-strut-insulation-1117 and 777-strut-bearing-2111, 2112, and 2113 – could be sent to us separately by your plant and not installed in the strut during the manufacturing of the engine. My crew would then install these parts in the engine struts after mounting the engine onto the wings. According to my research, this proposal should not affect either the safety or efficiency of your manufacturing process. You would simply hold these parts aside, package them for us, and ship them to us with the completed engine struts.

Next Steps
I'd like to hear from you about this proposal. Then, I would like to work with you to create new specifications and drawings for the new manufacturing process. Thanks. I'll look forward to hearing from you.

David Robinson: Additional Research and Writing Exercises

1. Research the history of the jet airplane up through the development of the 777. Using drawings, photos, and text, please prepare a two-page essay and/or a five-minute oral presentation that describes when the jet airplane was first developed, how it has changed over the years, and how the 777 differs from earlier jets.

2. The components that make up the 777 come from factories and companies located all over the world. Research how companies like The Boeing Company manage to create a product using components from many places. How do they make sure that parts arrive where they're needed when they're needed? How do they make sure that a part another company has made will work correctly and fit correctly? Using diagrams, drawings, and text, prepare a two-page essay and/or a five-minute oral presentation that describes how this process works.

3. The 777 is the first jet airplane to be completely designed by computer. How is this done? Are other products – like cars or houses – designed this way? Using diagrams, photos, drawings, and text, prepare a two-page essay and/or five-minute oral presentation that describes the current state of computer-aided design.

For each of these assignments, students can work individually or in small groups. They can use the library or the Internet (including Boeing's web site www.boeing.com) to complete their research.